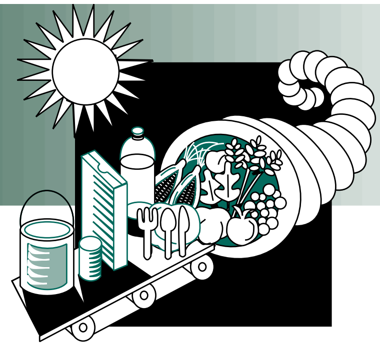
# AGRICULTURE

**Project Fact Sheet**



## Utilization of Corn-Based Polymers

### Benefits

- Uses carbon that plants harvest from $CO_2$ during photosynthesis and converts the carbon into a new generation of plastic
- Consumes 20-50 percent less energy than manufacturing conventional plastic resins
- Competes in a market based on price and performance, with a better environmental profile than today's plastics
- Projected 2020 target market is 8 billion pounds of PLA per year
- Projected 2020 fossil fuel displacement is 194 trillion Btu

### Applications

Projections are that 10 percent of the nonrenewable plastics packaging in this country can be replaced with PLA. New consumer products will be possible when PLA materials can be processed in molds and dies.

## Plastics from Renewable Resources Offer Significant Commercial and Environmental Benefits

Each year, 60 billion pounds of thermoplastics are produced from imported and domestic oil to make industrial and consumer products. A commercially useful form of polylactic acid (PLA) with superior performance attributes can replace thermoplastics at a competitive cost in applications used to produce containers, film, and fibers for apparel and carpeting. However, the broader range of applications for PLA and other renewable plant/crop-based plastics will not be realized until more is known about the chemical, physical, and mechanical properties of these new plastic materials.

This project will explore how modifying the chemical structure of PLA can improve its performance properties. Adhesion can be controlled by the PLA structure and flow properties and by chemical interactions between PLA and substrate. Blends of PLA and other polymers can also be used to expand the range of properties and serve as the basis for new materials. Understanding the fundamental relationships between PLA structure and processing will enable a wide variety of new applications for PLA, including the adhesion of PLA to paper and carboard surfaces.

**Plastics from Renewables**

**Renewable resources, such as this field of corn, can be used to manufacture polymers.**

## Project Description

**Goal:** To develop fundamental scientific knowledge and structure-property relationships on polylactic acid (PLA) in order to produce more value-added consumer products from this new plastic derived from renewable plant materials.

The stereochemistry of PLA is complex and not well-understood. Technical research will be conducted in three areas to help clarify PLA structure and behavior. Investigations into **Processing and Rheology** will seek a better understanding of the flow, crystallization, and solid-state mechanical properties of PLA blends in order to produce consumer products by injection molding. Studies will also be conducted in **Interfacial Engineering** on the adhesion mechanisms between PLA and other materials, particularly paper products and mold and die walls. The chemical and physical properties and behavior of PLA at interfaces with other materials (e.g., paper, metal) will be analyzed. Work will also be performed in the area of **Molecular Architecture and Phase Morphology** to develop better chemistries and thereby improve physical properties for lactide-containing polymers.

## Progress and Milestones

- A 10 percent replacement of nonrenewable chemical feedstocks with a renewable product will meet a goal of the agriculture industry's vision.
- The development of a predictive model for PLA will help the design and selection of PLA structures and mixtures for new applications.
- Knowledge of PLA's molecular features will allow for the adhesion of PLA to the surface of other materials.

### Project Partners

Cargill Dow LLC
Minnetonka, MN

Colorado School of Mines
Golden, CO

National Renewable Energy Laboratory
Golden, CO

### For additional information, please contact:

Douglas L. Faulkner
Office of Industrial Technologies
Phone: (202) 586-2119
Fax: (202) 586-3237
doug.faulkner@ee.doe.gov

Please send any comments, questions, or suggestions to
webmaster.oit@ee.doe.gov

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www.oit.doe.gov

Office of Industrial Technologies
Energy Efficiency
and Renewable Energy
U.S. Department of Energy
Washington, D.C. 20585

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